REMARKS/ARGUMENTS

Reconsideration of this application is respectfully requested.

The rejection of claims 1-16 under 35 U.S.C. §101 as allegedly not defining statutory subject matter is respectfully traversed.

In the first place, on Monday, June 28, 2010, the Supreme Court decided the *In re Bilski* case holding, *inter alia,* that the "machine/transformation" test is not the sole test for defining statutory subject matter.

Secondly, even if that test is applied, these claims have been amended so as to explicitly "tie" both independent method claims 1 and 11 to particularized apparatus (i.e., a "machine") that is configured to perform enumerated digital signal processing functions of digitized video signals. Claim 11 already requires generation of at least one panoramic image representing plural frames of the video sequence using global motion estimations thus determined. Claim 11 has been amended above so as to also now require the storing or outputting of such panoramic image data. Independent claim 1 has been amended above so as to require the storing or outputting of the selected motion estimation for use in registering the image of the frame being processed with the image of the anchor frame.

Such explicit recitations in method claims 1 and 11 go well beyond any "insignificant" post solution or extra solution activity. These claims define statutory processes

(i.e., methods) of considerable utility for processing frames of motion-compensated inter-frame encoded video sequences – and producing very useful outputs (e.g., so as to facilitate the generation of a panoramic image from a plurality of frames). These limitations go well beyond merely defining a "field of use".

Should the Examiner continue to find non-statutory subject matter at claims 1-16, then it is respectfully requested that the undersigned be telephoned for discussion/interview and prompt resolution.

The rejection of claims 1, 5, 17, 21 and 32 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh WO '879 in view of Meer is respectfully traversed.

In a nutshell, the applicants' invention estimates motion between entire frames – based on already encoded video sequence frames, each frame having embedded motion vectors for <u>sub-parts</u> (e.g., blocks thereof). Oh relates to <u>en</u>coding such sub-part motion vectors, but never once attempts to generate a <u>single</u> estimated motion vector for an entire frame!

The Examiner alleges that Oh teaches "every principle" in a <u>de</u>coding environment. However, this is incorrect. Oh merely mentions that the <u>en</u>coding technique described in detail throughout the description at pages 1-26 may be included in an <u>en</u>coding environment that may be collocated with, but not included in, a <u>de</u>coding environment.

A single reference in Oh to "de coding" is found in the last few lines of Oh at page 17, lines 26-29. In contrast to the single, passing reference to "*an integrated circuit for encoding/decoding video data*", there are 45 references to *"coding"* or *"coded"* included in Oh (i.e., excluding the abstract and claims). Oh cannot teach a decoding technique when it provides no details of any decoding activity.

On the basis of a single reference to "*an integrated circuit for encoding/decoding video data*" located at the end of Oh's specification, the Examiner alleges that Oh teaches decoding of motion vectors. However, the ordinarily skilled reader of Oh would learn that the adaptive motion estimator function of Oh comprises encoding a picture using the video encoder illustrated in Figure 1 – not decoding. That Oh is exclusively concerned with coding/encoding is clear from reading Oh's abstract, which begins (emphasis added) "*[a] method and apparatus of encoding digital video...*" This is equally clear from the statement of invention which begins (emphasis added) "*[i]n accordance with the present invention, there is provided a method for improved data block matching in a moving pictures encoder for encoding a sequence of pictures...*". This also clear from the first line of Oh's claim 1 that is directed to (emphasis added) "*[a] method for motion estimation for use in encoding a picture...*" It is further clear from the entire description which comprises 45 references to *"coding"* or *"coded"*.

If Oh had intended the subject matter to include some kind of decoding method/means, then this would have been reflected in the wording of the abstract and

claims and, in particular, in a description of decoding method/means that was sufficiently detailed to allow the skilled reader to implement it without undue trial and error. This is not the case: no such details are present. The mere indication of the possibility that the encoding means, described in detail throughout Oh, may be collocated with a decoding means not described in Oh provides no basis for concluding that Oh teaches decoding. While that which is encoded will likely later be decoded is not disputed. However, the art of decoding is distinct from that of encoding.

Applicants' claim 1 is directed to processing frames of a motion-compensated inter-frame already encoded video sequence, the processing requiring decoding of embedded motion vectors as a first step. The absence from Oh of any teaching of decoding (even of motion vectors) is indicative that Oh is describing a different process, and a study of Oh quickly establishes that Oh is, in fact, describing a process of encoding – not decoding. Any other interpretation of Oh is contrary to fact.

The Examiner uses an abbreviated summary of the applicants' claimed feature(s), which is unhelpful and results in a misrepresentation. The true claim wording reads: *"[a] method of global motion estimation between frames of a motion-compensated inter-frame encoded video sequence, each frame of the sequence having a plurality of motion vectors encoded therein relating sub-parts of one frame to sub-parts of a preceding and/or succeeding frame of the sequence; the method comprising..."*

Claim 1 requires inputting of motion-compensated inter-frame encoded frames and deriving an estimation of global motion between entire input frames. Oh teaches inputting raw, unencoded video and generating as output motion-compensated inter-frame encoded frames: see especially the Detailed Description of the Preferred Embodiments at page 9, lines 6-11 (emphasis added):

> *"[a] picture sequence encoder according to a preferred embodiment of the present invention encodes each input picture by...performing necessary motion compensation (predicted or interpolated) using the detected motion vectors, and subjecting all MBs to a transform coder followed by a statistical coder."*

Oh does not describe the applicants' claimed global motion estimation (i.e., a single motion estimate for an entire frame). For example, no reference is found in Oh to "global motion estimation", but rather Oh refers to (emphasis added): *"a global motion estimator coupled to receive block motion vectors for data blocks of a previously processed picture with respect to a reference picture for generating a plurality of global motion vectors for the picture"* (page 5, lines 4-6). It is crucial to the understanding of Oh to note that Oh uses the term "global motion" to describe a different concept than that defined in relation to the applicants' claimed invention. Oh uses the term "global motion" to describe motion associated with a part of an image (i.e., a block or group of related blocks within a single image). However, in the applicants' claimed invention, the

term is used to describe motion of a whole image frame (with respect to some other whole image frame).

On page 9, lines 13-19 (referred to by the Examiner in this context), Oh describes the motion vectors of a previous picture being analyzed (in some way not specified there) to produce what is described as "global motion vectors", but only for parts of an image (emphasis added):

> *"The global motion estimator is updated with MB motion vectors from the past processed pictures by the adaptive motion estimator. The preceding pictures motion vectors are used to generate one or more global motion vectors for each group of MBs in a new picture to be coded based on the type of global motion estimator selected. Generated global motion vectors are used to offset search windows of all MBs in the corresponding group of MBs. For the case of more than one global motion vector, a comparison at MB level is done and the global motion vector that gives the best result is chosen."*

This does not correspond to generating a single truly global motion vector for a whole image. The "global" motion vectors of Oh are used in an entirely different way than the global motion estimation of the applicants' claimed invention. Each "global" motion vector of Oh is used to determine where to place one of a plurality of search windows within the current frame. The search windows are used to find a block in the current frame that best matches a specific block in a previous frame. Having determined the most suitable match, a vector is generated to represent the motion between

the block position in the previous frame and the matched block position in the current frame (e.g., see page 10, lines 26-29 (emphasis added)):

> *"[a]ll necessary motion vectors, for example the frame and/or field, forward and/or backward, and 16x16/16x8/8x8 motion vectors, for each MB are detected by the adaptive motion estimator 102 by matching the MB to candidate blocks obtained from one or more search windows from a reference picture stored in a frame buffer 103."*

This is not addressed by the applicants' claims. Instead, the global motion estimation of the applicants' claimed invention represents selection of the best single motion vector among the plural pre-existing sub-part motion vectors of a frame that is already in the encoded state.

The plurality of "global" motion vectors per frame described in Oh probably correspond more closely to the (non-global) motion vectors of the applicants' invention, a plurality of which exist for each frame. The plurality of "global" motion vectors described in Oh do not, however, actually correspond at all closely even to these (non-global) motion vectors of the applicants' invention because the "global" motion vectors of Oh relate to blocks in raw, unencoded frames and are used in the process of matching an unencoded block in the current frame with an unencoded block in a previous frame as part of the encoding of the frame. The block matching of Oh relates to a comparison of pixel values, but this plays no part in the applicants' claimed invention.

No comparison of pixel values will, in any case, be possible between the encoded frames of the claimed invention inasmuch as the encoding hides these raw pixel values.

The above-quoted sections of Oh do not describe the applicants' claimed invention, which assesses sub-part motion vectors of an already encoded frame. According to applicants' claim 1, *N* sets of sub-part motion vectors are selected from an encoded frame; from each set a motion estimate is calculated from the anchor frame *vis-à-vis* the current frame. The performance of resultant motion estimates are assessed and the estimate that has the best performance is selected to represent, in a single entity, the global motion of the whole (entire) frame with respect to the entire anchor frame.

The Examiner persists in the view that Oh teaches "calculation of an error value for motion estimation for sets of motion vectors" and refers to Oh at page 11, lines 4-6 (here put in the context of page 10, line 26 – page 11, line 7, (emphasis added)):

> *"All necessary motion vectors, for example the frame and/or field, forward and/or backward, and 16×16/16×8/8×8 motion vectors, for each MB are detected by the adaptive motion estimator 102 by matching the MB to candidate blocks obtained from one or more search windows from a reference picture stored in a frame buffer 103. Different matching methods such as the exhaustive search method, the logarithmic search method, multi-steps or hierarchical search method, and search windows sizes and numbers may be utilized depending on application/implementation needs as well as the type of motion estimator selected within the adaptive motion estimator 102. Matching methods may also be implemented in various pixel resolutions, for example integer, half pel or quarter pel resolution. The matching*

> *criterion may be based on minimum of absolute errors, square errors, or other suitable distortion functions. A detailed description of one form of the adaptive motion estimator 102 is presented hereinbelow in connection with Figure 2."*

Careful reading of Oh clearly indicates that the error calculation, relied upon by the Examiner, relates to matching of blocks of pixels in two images – and not to comparing sub-part motion vectors. Oh does not teach the use of LMedS error of the applicants' invention to determine the best single global frame motion estimate out of a set of sub-part motion vectors disposed within an encoded frame.

The Examiner also persists in the view that Oh teaches "selection of any motion estimation for sets of motion vectors as representative of the global motion of the frame with respect to a preceding or succeeding anchor frame". However, in this assertion, the Examiner uses an abbreviated summary of the claimed feature which is unhelpful and results in a misrepresentation of the claim. The true claim wording reads: *"selecting the motion estimation with the least median squared error value as that representative of the global motion of the entire frame with respect to a preceding or succeeding entire anchor frame".*

The Examiner further persists in the view that Meer teaches "calculating a median squared error value for each motion estimation". However, Meer ("Robust Regression Methods for Computer Vision: A Review") discusses use of least median squared (LMedS) error only to process noisy data. The Examiner refers to the right-

hand column on page 62, which discusses general properties of LMedS and the type of data that would be suitable to use with it. The Examiner alleges that Meer teaches calculating a median squared error value for motion estimation. Referring to applicants' claim wording, no teaching can be found in Meer to use of the LMedS technique for calculating a median squared error value <u>for a motion vector estimate</u>. It follows that no teaching can be found in Meer to select the <u>motion estimate</u> with the least median squared error value.

The Examiner has not indicated any particular Meer text that allegedly describes calculating a median squared error value for each <u>motion estimate</u> – or selecting the <u>motion estimate</u> with the least median squared error value. If the Examiner believes that Meer does describe these activities, the Examiner is invited to indicate, in the interests of efficient prosecution, the precise text upon which he is relying.

The rejection of claims 2-4 and 18-20 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer in further view of Smolic is also respectfully traversed.

Fundamental deficiencies of both Oh and Meer have been noted above with respect to a parent claim. Smolic does not supply those deficiencies. Accordingly, it is not necessary at this time to detail additional deficiencies of this allegedly "obvious" three-way combination of references with respect to additional aspects of these rejected claims. Suffice it to note that, as a matter of law, it is not possible to support even a

prima facie case of "obviousness" unless the cited prior art at least teaches or suggests each and every feature of each rejected claim.

The rejection of claims 6-8 and 22-24 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer in further view of Subramaniyan '134 is also respectfully traversed.

Once again, fundamental deficiencies of Oh/Meer have already been noted above with respect to a parent claim. Subramaniyan does not supply those deficiencies and, accordingly, for reasons noted above, it is not necessary at this time to address additional deficiencies of this allegedly "obvious" three-way combination of references with respect to the additional aspects of these rejected claims.

The rejection of claims 10 and 25 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer/Subramaniyan in further view of Lee '568 is also respectfully traversed.

Once again, fundamental deficiencies of Oh/Meer have already been noted above with respect to a parent claim. Neither Subramaniyan nor Lee supplies these deficiencies. Accordingly, for reasons already noted above, it is not necessary at this time to detail additional deficiencies of this allegedly "obvious" four-way combination of references with respect to other aspects of these rejected claims.

The rejection of claims 26-29 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer in further view of Jinzenji '664 is also respectfully traversed.

Fundamental deficiencies of Oh/Meer have already been noted above with respect to a parent claim. Jinzenji does not supply those deficiencies and, accordingly, for reasons already noted, it is not necessary at this time to detail additional deficiencies of this allegedly "obvious" three-way combination of references with respect to other aspects of these rejected claims.

The rejection of claims 30-31 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer/Jinzenji in further view of Szeliski '918 is also respectfully traversed.

Once again, the third and fourth cited references do not supply already noted fundamental deficiencies of the first and second cited references with respect to a parent claim. Accordingly, for reasons noted above, it is not necessary at this time to detail additional deficiencies of this allegedly "obvious" four-way combination of references.

The rejection of claims 11-14 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer in further view of Jinzenji '664 is also respectfully traversed.

The Oh/Meer references have essentially similar deficiencies with respect to independent claim 11 as already discussed with respect to independent claims 1 and 17.

Oh is directed to a method of <u>en</u>coding digital video data (see abstract) and teaches a motion detection method designed for this purpose that differs fundamentally from applicants' claimed method (e.g., see page 14, lines 14-18 (emphasis added)):

> *"The calculated global motion vectors are used in subsequent picture(s) to offset the search window(s). This is diagrammatically illustrated in FIG. 4 for the case of two global motion vectors per row. The first search window for a current MB <u>to be coded</u> is determined from a reference picture 401 by first determining the position of a co-sited macroblock 402 on the reference picture 401."*

Oh teaches *"improved methods and apparatus for motion vector detection in a video data <u>encoder</u>"* (page 17, lines 5-7). Oh does not teach the global motion vector calculation of applicants' claimed invention for <u>decoded</u> image data. There is no motivation in Oh for *"decoding the motion vectors of the frame"* – no encoded data is <u>de</u>coded in Oh – rather, it is only <u>en</u>coded data that is generated.

The Examiner is correct in pointing out that Oh claims an invention that *"can be incorporated in an integrated circuit for encoding/decoding video data"* (page 17, lines 26-29). However, Oh does not teach any <u>de</u>coding functions of such integrated circuit. Oh teaches video data <u>en</u>coding – <u>not</u> video data <u>de</u>coding.

Oh's "global" motion vectors are calculated based on the results of comparing raw data (i.e., pixels) from two successive raw, unencoded images from a video sequence. Oh searches a second image of the sequence for a block that matches each block of the previous image from the sequence. Oh then calculates a value of motion vector for each block from the offset (difference in coordinates) between the positions of the matching blocks in the two images.

The applicants' claimed invention processes motion vectors decoded from a motion-compensated inter-frame encoded video sequence (not freshly generated from a comparison of unencoded raw images), selecting a plurality of sets (N>1), each associated with motion vectors (i.e., plural). The plurality of motion vectors is then processed, as claimed, to generate a single representation of estimated global motion between frames.

Oh does not teach estimating global motion between frames, as claimed, but instead generates so-called "global motion vectors" that relate, not to movement of a whole image frame, but only to a sub-section thereof (i.e., a row or part of row). Oh's intention is to create an encoded form of an input frame through generating a plurality of vectors to describe the different offsets of the various blocks within a single frame with respect to similar blocks within a previous single frame. The result is a plurality of vectors – but no single value representative of global motion between two whole frames.

The Examiner here acknowledges that Oh does not teach *"calculating a **median squared error value** for each motion estimation"*. To be more accurate, Oh does not teach calculation of <u>any</u> error value for <u>motion estimation for sets of motion vectors</u> (as claimed). The Examiner refers to page 11, lines 4-6, but this describes use of error values in the matching of <u>blocks or MB</u> (i.e., parts of images – see page 10, line 26 to page 11, line 6, particularly *"<u>matching</u> the MB to candidate blocks obtained from one or more search windows from a reference picture stored in a frame buffer"* and *"[t]he <u>matching criterion</u> may be based on minimum of absolute errors, square errors, or other suitable distortion functions."*) Oh describes use of error values in the matching of blocks or MB (i.e., parts of images) <u>not</u> calculating error values for motion estimation for sets of motion vectors.

The Examiner also acknowledges that Oh does not teach *"the motion estimation **with the <u>least</u> median squared error value** as that representative of the global motion of the frame with respect to a preceding or succeeding anchor frame"*. To be more accurate, as previously noted, Oh does not teach selection of <u>any</u> motion estimation <u>for sets of motion vectors</u> as representative of the global motion of the frame with respect to a preceding or succeeding anchor frame (as claimed).

The Examiner cites Oh at page 14, lines 24-26, but here Oh is describing selecting a prediction of the position of a macroblock in a subsequent image that best matches a block in the current image not selection of a motion estimation <u>for sets of</u>

motion vectors (as applicants have claimed) - see Oh where cited: *"[t]he two best macroblock matching predictions obtained from the two search windows are compared and the one giving the best prediction is chosen."*

Meer teaches, at the cited section (page 62, right-hand column), use of the projection pursuit technique for the reduction of a multi-dimensional regression problem to one dimension. The least median squared error (LMedS) technique is described as being used to identify outliers in raw data. At page 62, left-hand column, the LMedS technique is described as being used for line fitting. The Examiner alleges that Meer teaches calculating a median squared error value for each motion estimation, but no teaching can be found in Meer to use of the LMedS technique to calculating a median squared error value for motion estimation. Similarly, no teaching can be found in Meer to use the LMedS values for selecting motion estimation.

The methods of applicants' claims 1 and 11 and the system of applicants' claim 17 overcome the effects of noise present in inter-frame encoded motion vectors to allow for global motion estimations between frames to be accurately performed. The Examiner has not shown any mechanism in the cited documents that provides this. In reality, no such method or system is taught or even hinted at in the cited prior art.

Given the fundamental deficiencies as already noted with respect to claim 11, it is not necessary at this time to detail additional deficiencies of these references with respect to other aspects of the rejected claims – for reasons already noted above.

The rejection of claims 15-16 under 35 U.S.C. §103 as allegedly being made "obvious" based on Oh/Meer/Jinzenji in further view of Szeliski '918 is also respectfully traversed.

Once again, fundamental deficiencies of Oh/Meer have already been noted above for a parent claim and, accordingly, since neither of the third and fourth cited references supply even those fundamental deficiencies, it is not necessary at this time to detail additional deficiencies of this allegedly "obvious" four-way combination of references with respect to other aspects of the rejected claims.

Accordingly, this entire application is now believed to be in allowable condition, and a formal notice to that effect is earnestly solicited.

Respectfully submitted,

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